

## Elastic-Memory Composite Antenna Booms for SmallSats, Phase I

Completed Technology Project (2018 - 2019)



## Project Introduction

Composite Technology Development, Inc. (CTD) seeks to advance the state of art with a novel deployable low-frequency antenna technology for SmallSats comprised of elastic memory composite antenna booms and deployer mechanisms. These booms incorporate a shape memory polymer matrix into a fiber-reinforced composite substrate with an outer metallization layer for RF performance. The elastic memory composite technology enables these antenna elements to be heated, rolled, and cooled to lock them into a stowed shape. They can be deployed smoothly with heat without inducing shock and without the need of for actuators or deployment motors. The long-length, low-frequency antenna elements can be packaged into exceedingly small stowed volumes, with simplified mechanisms, lower parts count, and lower mass than current state of the art boom and deployer systems.

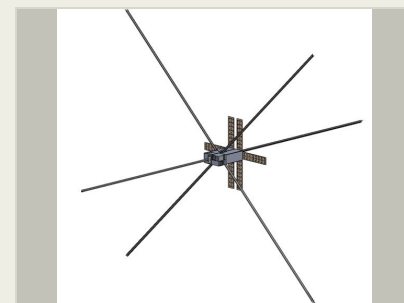
The primary technical objectives of the proposed effort are as follows:

- Develop a series of system requirements for the development effort
- Demonstrate feasibility of the elastic memory composite antenna boom concept through a comprehensive design, analysis, and prototyping effort
- Design and build a prototype metalized elastic memory composite antenna boom
- Design and build a prototype elastic memory composite boom deployer
- Perform deployment testing of a breadboard prototype at the end of Phase I

## Anticipated Benefits

The proposed technology advances state of the art deployable low-frequency antenna technologies for CubeSats or SmallSats. Applications include radar sounding booms such as those used on prior missions including MARSIS and future missions such as Europa Clipper. Currently, NASA requires increased capability in CubeSats to meet demands for lower-cost, multi-point observations throughout space leveraging lower cost SmallSats and CubeSats.

The proposed technology is applicable to a wide-range of SmallSat deployable systems for the growing non-NASA market. For example, SmallSats are being utilized by the National Science Foundation, Air Force, and commercial entities such as One-Web. Additionally, the National Reconnaissance Office has purchased many CubeSats under its Colony One and Colony Two programs.



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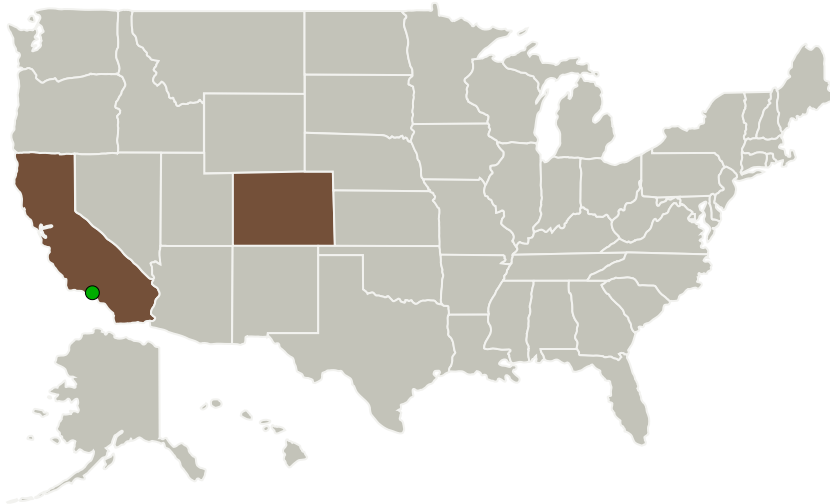
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Composite Technology Development, Inc.	Lead Organization	Industry	Lafayette, Colorado
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

## Primary U.S. Work Locations

California	Colorado
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## Project Transitions

**July 2018:** Project Start**February 2019:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/141031>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Composite Technology Development, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

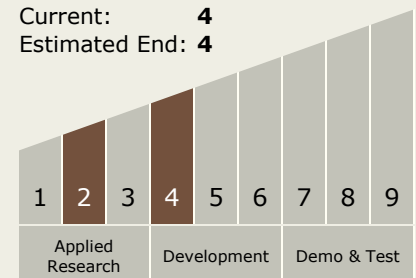
Alexi Rakow

## Technology Maturity (TRL)

Start: 2

Current: 4

Estimated End: 4



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## Images



### Briefing Chart Image

Elastic-Memory Composite Antenna Booms for SmallSats, Phase I  
(<https://techport.nasa.gov/image/126044>)



### Final Summary Chart Image

Elastic-Memory Composite Antenna Booms for SmallSats, Phase I  
(<https://techport.nasa.gov/image/133249>)

## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

## Target Destinations

The Moon, Mars, Earth